WÜRSIG, B., AND M. WÜRSIG. 1977. The photographic determination of group size, composition and stability of coastal porpoises (*Tursiops truncatus*). Science 198:755–756.

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DIGITAL PHOTOGRAPHY IMPROVES EFFICIENCY OF INDIVIDUAL DOLPHIN IDENTIFICATION: A REPLY TO MARKOWITZ ET AL.

Mizroch and Bigg (1990) provided a short guide to photographing whales from small boats. Topics we covered included choice of film, framing and focusing tips, suggestions about exposure times, and tips and examples on processing and printing images. In the 12 yr since we published our note, our methods have remained virtually the same, but our choice of black and white negative film has evolved from Ilford HP-5 (rated at 400 ASA but usually shot at 1600 ASA) to Fuji Neopan 1600 (shot at 1600 ASA or shot at 800 ASA if light conditions permitted) and most recently to Kodak TMAX 3200 (shot at 800 or 1000 ASA). With some of the newer high-speed black and white films, the nominal ASA (*i.e.*, 1600 or 3200) is usually not the optimum film emulsion speed. The optimum speed for both Neopan and TMAX is closer to 800, and the optimum speed for HP-5 is 400.

Recently, researchers have begun exploring the use of high-resolution (>5 megapixel) digital cameras, most commonly the Nikon D1X. Some of the humpback whale researchers working in the North Pacific have begun using the Nikon D1X, and their digital images are decidedly better than their scanned color slides. Markowitz *et al.* (2003) have compared images from their existing dolphin fin catalog (shot with mostly slide film?) to digital images shot with the Nikon D1, and found that the digital images were better. However, the question remains for those of us using high-speed black and white film, is digital a better format for photo-identification than the film we currently use?

With the help of a Seattle, WA, professional black-and-white photo lab (Panda Photographic Laboratories, Inc.), we devised a simple test to compare the two black-and-white films we commonly use (Neopan 1600 and TMAX 3200, both shot at 800 ASA), to the Nikon D1X (set at 800 ASA, high resolution, black and white, Y Cr Cb). We mounted a newspaper financial page with stock market tables in very small type and graphics on an easel set outside in natural lighting on an overcast day. We placed a Nikon 300-mm f4 ED-IF lens on a tripod and set the lens aperture at f8 and mounted first the film cameras then the digital camera back to the lens for the comparison test. The image in the camera viewfinder was 1.5 times larger in the digital camera than in the film camera, so when shooting with the digital camera, the tripod was moved back to ensure the exact same section of the newspaper was in all the shots.

Each camera meter was set to the spot meter setting and a photographic (18% reflectance) gray card was used to determine the optimum exposure. We took one shot at this optimum exposure, then bracketed the exposure with shots at shutter speed one setting above and one setting below the optimum setting. Then we changed the exposure compensation (±) button on the camera to an exposure value of +0.7, determined the optimum exposure with the gray card, took one shot at the optimum exposure, and then bracketed this exposure with shots at different shutter speeds.

The best-exposed negative for each film (*i.e.*, most information on the negative) was the optimum (gray card) exposure with the camera exposure compensation set at +0.7. In producing prints for the comparison tests, the image on each film negative was enlarged to the maximum size possible using an Omega D2V XL photo enlarger with an extra long chassis and a 50-mm enlarger lens, and print densities were matched as closely as possible. We printed the best digital image on high-quality photographic paper using three different state-of-the-art photo printers (Epson 2000P, Epson 1280, and Canon S900).

We showed the two film images to staff at the Alaska Fisheries Science Center's (AFSC) Graphics Unit and National Marine Mammal Laboratory (NMML), asking each person to "please take a look at these photos and give us your impressions." Each of the viewers initially preferred the look of the Fuji print because, with inherently higher contrast, it was more pleasing to the eye at first glance. However, in all cases, when looking at the fine detail in each print, they unequivocally preferred the TMAX print because the fine details (*i.e.*, the weave of the newspaper, dots per inch on the newspaper graphics, wrinkles and smudges on the paper) were much better resolved.

We then showed the three digital images to each viewer. Most viewers felt the prints were similar enough to consider the printers to be about equivalent. All viewers noticed that the finest details (weave of the paper, smudges, *etc.*) had not been resolved on the prints (nor were they present on the digital images on a high-resolution computer monitor). However, the next level of enlarged details, (*i.e.*, the small numbers, dashes, dots, and graphics lines) were very well rendered, and we were all impressed by the clarity and sharpness of the enlarged digital image.

During the course of this exercise, some misapprehensions about photography became obvious. Generally, people tend to prefer the look of higher contrast images but, for photo-ID studies, the data are most often in the shadow details. Some films may "look" better at initial glance, but are inherently higher in contrast and lose detail in the shadows. Other films may look "softer" or grayer, but they load much more detail on the negative. This detail allows us to match features based on a much wider suite of characteristics and gives us much more detail when enlarging a distant image. When choosing a film, researchers should try to choose a film to maximize shadow detail and minimize contrast.

There is also some confusion about fine-grain *vs.* high-speed films. Some researchers have assumed that fine grain films (*e.g.*, TMAX 400) are better for photo-ID, but that assumption is not true. The fine-grain films do not render edge detail in the shadow areas very well, and the subtle photo-ID characteristics are in the shadow areas. With the newer high-speed film, grain size has never interfered with our ability to read the fine details, even in the extreme test case presented here. Further, the newer high-speed black-and-white films, when properly processed, are not excessively grainy. Some of the newer developers can actually enhance film speed and reduce apparent grain size.

I agree that digital photography is very promising for photo-ID studies, but until more side-by-side film versus digital camera tests are conducted, digital images cannot be considered superior to film. The film used in Markowitz *et al.* (2003) is not considered adequate for our photo-ID studies, and the scanner they used is not as technologically advanced as those that are available currently. In my experience, images taken with the Nikon D1X are demonstrably better than scanned images of Kodachrome or Ektachrome color slides, so I agree with Markowitz *et al.* (2003) that digital may be a better choice for them. However, in terms of absolute image quality, a properly exposed, processed, and scanned high-speed black-and-white film image would have as many, if not more, subtle details as a well-exposed digital image.

Another possible disadvantage of digital photography is its potential sensitivity to harsh field conditions. I have found my Nikon N90s to be robust even in extreme weather conditions, but I am reluctant to use a $4,000–$5,000 digital camera in an open skiff in the typical field conditions in coastal Washington and Alaskan waters.

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Literature Cited

Markowitz, T. M., A. D. Harlin and B. Würsig. 2003. Digital photography improves efficiency of individual dolphin identification. Marine Mammal Science 19:217–223.

Mizroch, S. A., and M. A. Bigg. 1990. Shooting whales (photographically) from small boats: An introductory guide. Annex K. Report of the Workshop on Individual Recognition and the Estimation of Cetacean Population Parameters. Reports of the International Whaling Commission (Special Issue 12):39–40.

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Erratum

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Reducing incidental mortality of Franciscana dolphin (*Pontoporia blainvillei*) with acoustic warning devices attached to fishing nets. *Marine Mammal Science* 18(4):833–842.

In our paper we wrote: "The widespread use of acoustic alarms to reduce cetacean bycatch was suggested by Dawson *et al.* (1998)." However, the sentence should have read: "The widespread use of acoustic alarms to reduce cetacean bycatch has been questioned by Dawson *et al.* (1998)."

I would like to thank Stephen Dawson for bringing this error to our attention.

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